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Crushed Stone

UNITED STATES DEPARTMENT OF THE INTERIOR

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This publication is a chapter from the current Bureau of Mines Minerals Yearbook, comprising *Volume I, Metals and Minerals; Volume II, Area Reports: Domestic; Volume III, Area Reports: International.* The separate volumes of the Yearbook are sold by the Superintendent of Documents, Washington, D.C. 20402.

Crushed Stone

By Valentin V. Tepordei[1]

A total of 1.2 billion short tons of crushed stone was reportedly produced in the United States in 1987, an increase of 17.3% over that of 1986. It is the highest production ever recorded in the United States, 9.2% more than the previous record-high production of 1.1 billion tons reported in 1979. About 70% of the crushed stone production continued to be limestone and dolomite, followed by granite, traprock, sandstone and quartzite, shell, marble, calcareous marl, volcanic cinder and scoria, and slate, in order of volume.

Foreign trade in crushed stone remained relatively minor. Exports and imports increased 10.3% and 25.5%, respectively. Ninety-seven percent of the exported and 37% of the imported crushed stone was limestone. Apparent consumption of crushed stone was 1.2 billion tons.

Table 1.—Salient U.S. crushed stone statistics

(Thousand short tons and thousand dollars)

	1983	1984	1985	1986	1987
Sold or used by producers:					
Quantity[1]	861,600	e956,000	1,000,800	e1,023,200	1,200,100
Value[1]	$3,327,000	e$3,755,600	$4,053,000	e$4,255,000	$5,248,600
Exports (value)	$23,021	$23,970	$29,347	$36,957	$26,063
Imports for consumption (value)[2]	$12,610	$17,543	$11,640	$12,451	$14,024

eEstimated.
[1]Does not include American Samoa, Guam, Puerto Rico, and the Virgin Islands.
[2]Excludes precipitated calcium carbonate.

Domestic Data Coverage.—Domestic production data for crushed stone are developed by the Bureau of Mines from voluntary surveys of U.S. producers. Full surveys of crushed stone producers are conducted for odd-numbered years only. For even-numbered years, preliminary surveys, which collect production information on a sample basis, are conducted to generate only annual preliminary estimates at the State level.

Of the 5,634 crushed stone operations surveyed, 3,473 were active. Of these, 2,677 or 77.1% reported to the Bureau of Mines. Their total production represented 80.2% of the total U.S. crushed stone output. The nonrespondents' production was estimated using adjusted prior years' production reports and/or employment data. Of the 2,677 reporting operations, 569 did not indicate a breakdown by end use. Their production, as well as estimates of 828 nonrespondents, representing 30.6% of the U.S. total, is included in tables 11, 13, and 15-18 under "Other unspecified uses." A total of 1,330 quarries were either idle or presumed to be idle, because no information was available to estimate their production.

Legislation and Government Programs.—On April 2, the U.S. Congress enacted the 1987 Surface Transportation Assistance Act (STAA), which extended the Federal-Aid Highway Program for 5 more years. The total funding was $68 billion, with annual authorizations ranging between $13.6 and $13.9 billion. On December 31, the Airport Improvement Program (AIP) legislation was enacted, which appropriated $1.7 billion for fiscal years 1988-90 and $1.8 billion for fiscal years 1991 and 1992. The $8.7 billion total represented a 65% increase in funding over the previous AIP.

Funding for the fiscal year 1988 program was later reduced by the Continuing Resolution (Public Law 100-202) by $0.57 billion for the STAA program and by $0.43 billion for the AIP.

Responding to requests made by the industry, the Occupational Safety and Health Administration (OSHA) extended a partial stay to July 21, 1988, for implementation of the new provisions of its revised asbestos standards for nonasbestiform varieties of actinolite, anthophyllite, and tremolite minerals. The stay was issued to allow OSHA time to review additional data regarding the feasibility of regulating these nonasbestiform minerals. The extension was needed because of the range of the affected industries and the lack of mineralogic and exposure data in these industries. The former asbestos standards remain in effect for the extent of the stay.

The introduction of the revised OSHA regulations regarding the airborne asbestos standards, which include nonasbestiform varieties of actinolite, anthophyllite, and tremolite, would have a very significant impact on the aggregates industries, consequently affecting the construction industries. The resulting costs to society, in the form of increased construction costs and disruption of the supply of aggregates, were considered potentially enormous according to industry estimates.

DOMESTIC PRODUCTION

Of the total 1.2 billion tons of crushed stone produced in the United States, 841 million tons or 70% was limestone and dolomite, 180 million tons or 15% was granite, and 103 million tons or 8.6% was traprock. The remaining 6.4% was shared by marble, calcareous marl, shell, sandstone and quartzite, slate, volcanic cinder and scoria, and miscellaneous stone.

A comparison of the four major geographic regions indicated that in 1987 the South continued to lead the Nation in the production of crushed stone with 47.7% of the total, followed by the Midwest with 26.2%, and the Northeast with 15.7%. Approximately 74% of the total U.S. crushed stone output was produced in two major geographic regions, the South and the Midwest. Of the nine geographic regions, the South Atlantic led the Nation in the production of crushed stone with 316 million tons or 26.3% of the U.S. total. Next was the East North Central region with 196 million tons or 16.3% of the total, followed by the Middle Atlantic with 154 million tons or 12.8%.

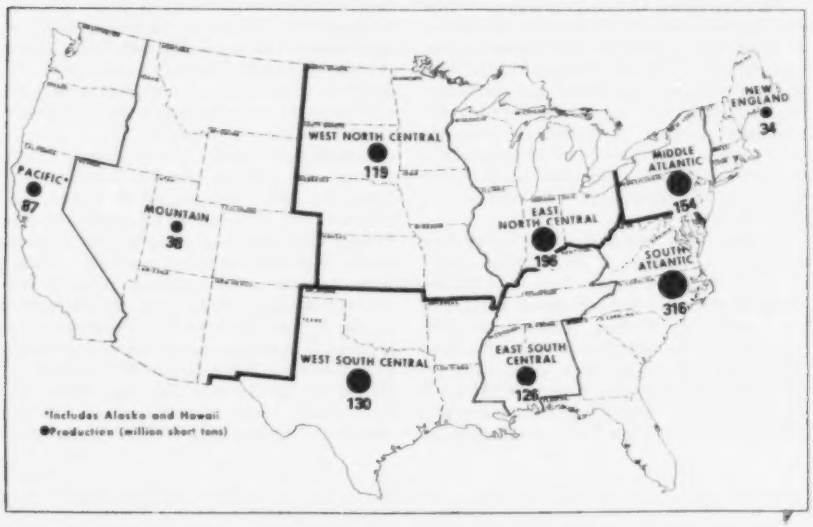

Figure 1.—Production of crushed stone in the United States in 1987, by geographic region.

A comparison of the estimated 1986 and reported 1987 production data by regions indicated that the output of crushed stone increased in all regions except the West South Central, which includes Texas. The largest increases were recorded in New England, 45.6%; the Middle Atlantic, 28.6%; and the East North Central, 28.2%.

Based on the 1985 Bureau of the Census population estimates, 1987 U.S. per capita crushed stone production was 5.0 tons. Per capita production by major geographic region was 7.0 tons in the South, followed by the Midwest with 5.3 tons, the Northeast with 3.8 tons, and the West with 2.6 tons.

Crushed stone was produced in every State except Delaware. The 10 leading States in the production of crushed stone, in order of volume, were Pennsylvania, Texas, Florida, Georgia, Virginia, Missouri, Illinois, Ohio, Tennessee, and North Carolina. Their combined production represented 53.4% of the national total.

ARC America Corp. of Newport Beach, CA, a subsidiary of Consolidated Gold Fields PLC of the United Kingdom, acquired American Aggregates Corp. of Greenville, OH, one of the largest aggregates producers in Ohio. American Aggregates owned a significant amount of reserves in the State and operated 10 crushed stone quarries and 12 sand and gravel pits.

Blue Circle Industries PLC of London, United Kingdom, acquired Raia Industries Inc. of Hackensack, NJ. Raia Industries operated a crushed stone quarry and ready-mixed cement operations in Sussex County, NJ.

Vulcan Materials Co. of Birmingham, AL, acquired White Mines Co. of San Antonio, TX. The purchase included a rock asphalt quarry at Uvalde, TX; a basalt quarry at Knippa, TX; and three limestone quarries at Brownwood, Abilene, and Weatherford, TX. The newly acquired operations were combined with Vulcan's existing Texas operation to form a new division with headquarters in San Antonio, TX.

Florida Rock Industries Inc. of Jacksonville, FL, acquired Arundel Corp. of Baltimore, MD, a large construction aggregates producer with operations in Delaware, Maryland, North Carolina, and Virginia. Prior to the acquisition, Florida Rock's 14 quarries were in Florida and Georgia.

Dravo Basic Materials Co. of Kenner, LA, acquired from Florida Crushed Stone Co. of Leesburg, FL, a limestone quarry at Perry, FL, that will allow Dravo to supply aggregates to the Tallahassee market. Dravo already has operations in Chattahoochee, Pensacola, and Tampa, FL.

USX Corp. of Pittsburgh, PA, sold its two Michigan limestone quarries, Calcite Quarry and Cedarville Quarry, to Michigan Limestone Operations Ltd., a newly formed company.

Limestone.—Beginning with the 1983 survey, a new canvassing procedure was implemented that is designed to collect separate information on the amount of limestone and dolomite produced in the United States. In 1987, 153 quarries reported producing only dolomite, while 35 additional quarries reported producing both limestone and dolomite, without making a distinction between the two kinds of stone. Therefore, the limestone totals shown in this chapter include an undetermined amount of dolomite, in addition to the dolomite reported separately. Compared with that of 1985, the 1987 output of crushed limestone, including some dolomite, increased 15.7% to 792 million tons valued at $3.2 billion. Limestone was produced by 1,130 companies at 2,496 quarries in 46 States. Leading States, in order of tonnage, were Texas, Pennsylvania, Florida, Missouri, and Illinois; these five States accounted for 39.6% of the total U.S. output. Leading U.S. producers were, in order of volume, Vulcan, Martin Marietta Aggregates, Koppers Co. Inc., Florida Rock, and the Rogers Group. These five companies accounted for about 16% of total U.S. output of limestone.

Dolomite.—Production of dolomite increased 55% to 49 million tons valued at $207 million. Crushed dolomite was reportedly produced by 86 companies in 24 States. An additional undetermined amount of dolomite is included in the total crushed limestone data. Leading States in the production of dolomite, in order of tonnage, were Pennsylvania, Michigan, Alabama, New York, and Ohio; these five States accounted for 67% of the total U.S. output. Leading U.S. producers were Glasgow Inc., Stabler Co., Bethlehem Steel Corp., Vulcan, and Michigan Minerals Associates; their combined production represented 44% of the total U.S. dolomite production.

Marble.—Production of crushed marble increased 129% to 5.6 million tons valued at $62 million. Crushed marble was produced by 18 companies at 47 quarries in 11 States. Leading States, in order of tonnage, were Virginia, California, Alabama, Georgia, and Vermont; these five States accounted for 93% of the total U.S. output. Leading pro-

ducers of crushed marble, in order of tonnage, were Koppers, CalMat Co., and Georgia Marble Co.; their combined production represented 65% of the total U.S. output.

Calcareous Marl.—Output of marl increased 5% to 4.2 million tons valued at $7.7 million. Marl was produced by 15 companies at 16 quarries in 7 States. South Carolina accounted for 81% of total U.S. output. Leading producers, in order of tonnage, were Dundee Cement Co., Giant Portland & Masonry Cement Co., and Gifford-Hill & Co.; their combined production represented 80% of the total U.S. output.

Shell.—Shell is mainly derived from fossil reefs or oyster shell. The output of crushed shell decreased 8% to 8.4 million tons valued at $51 million. The decrease is mostly due to the restrictions imposed on the industry in Louisiana as a result of concerns that shell dredging produces irreversible damage to the environment. Crushed shell was produced by 15 companies from 19 operations in 7 States. The major producing States were Louisiana and Florida and the leading producers, in order of tonnage, were Dravo, Ashland Oil Inc., Leisey Shell Corp., Pontchartrain Dredging Corp., and Quality Aggregates Inc.; their combined production represented 77% of the U.S. output.

Granite.—Compared with that of 1985, the 1987 output of crushed granite increased 24% to 180 million tons valued at $901 million. Crushed granite was produced by 136 companies at 735 quarries in 31 States. Leading States, in order of tonnage, were Georgia, North Carolina, Virginia, South Carolina, and California; these five States accounted for 76% of the U.S. output. Leading U.S. producers, in order of tonnage, were Vulcan, Martin Marietta, Koppers, Georgia Marble, and Tarmac America; their combined production represented 54% of the U.S. total.

Traprock.—Production of crushed traprock increased 24% to 103 million tons valued at $505 million. Traprock was produced by 257 companies at 813 quarries in 23 States. Leading States, in order of tonnage, were Oregon, New Jersey, Washington, Connecticut, and Massachusetts; these five States accounted for 58% of U.S. output. Leading U.S. producers, in order of tonnage, were Tilcon Inc., U.S. Forest Service Region 3, Traprock Industries Inc., Koppers, and Chantilly Crushed Stone Inc.; their combined production accounted for 25% of the total U.S. output.

Sandstone and Quartzite.—The combined output of crushed sandstone and quartzite increased 40% to 32 million tons valued at $158 million. Crushed sandstone was produced by 121 companies at 181 quarries in 27 States, while crushed quartzite was produced by 28 companies at 28 quarries in 17 States. Leading States in the production of sandstone were Pennsylvania, Arkansas, and California and for quartzite Georgia, South Dakota, and Virginia; the three States accounted for 55% of the U.S. output of sandstone and 61% of the U.S. output of quartzite. Leading producers, in order of tonnage, were Arkhola Sand and Gravel Co., Commercial Stone Corp., and Dutra Construction Co. for crushed sandstone, and Martin Marietta, Salem Stone Corp., and Concrete Material Co., for crushed quartzite.

Slate.—Compared with that of 1985, the 1987 output of crushed slate increased 201% to 2.3 million tons valued at $14.3 million. Crushed slate was produced by 8 companies at 10 quarries in 6 States. Leading States, in order of tonnage, were North Carolina and Georgia. Leading producers, in order of tonnage, were Martin Marietta, Big River Industries, and Lesuer-Richmond Slate Corp. The top three producers accounted for most of the U.S. output of crushed slate.

Volcanic Cinder and Scoria.—Production of volcanic cinder and scoria increased 23% to 3.7 million tons valued at $15 million. Volcanic cinder and scoria were produced by 39 companies from 359 operations in 13 States. Leading States, in order of volume were, Oregon, Arizona, California, North Carolina, and Hawaii; their combined production accounted for 78% of the total U.S. output. Leading producers, in order of tonnage, were the U.S. Forest Service, Martin Marietta, and U.S. Industries Inc.; their combined production accounted for 44% of U.S. output.

Miscellaneous Stone.—Output of other kinds of crushed stone increased 43% to 19 million tons valued at $78 million. Miscellaneous stone was produced by 59 companies from 304 quarries in 22 States. Leading States, in order of volume, were Pennsylvania, Maryland, and Florida; their combined production accounted for 70% of the total U.S. output. Leading producers, in order of tonnage, were Rockville Crushed Stone, Capeletti Inc., and Gill Quarries Inc.

Table 2.—Crushed stone sold or used in the United States, by kind

Kind	1986				1987			
	Number of quarries	Quantity (thousand short tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand short tons)	Value (thousands)	Unit value
Limestone	2,316	685,002	$2,618,621	$3.82	2,496	792,448	$3,249,713	$4.10
Dolomite	87	31,348	133,271	4.25	119	48,656	206,904	4.25
Marble	22	2,437	20,439	8.39	51	5,576	62,335	11.18
Calcareous marl	14	3,959	8,083	2.04	16	4,154	7,650	1.84
Shell	17	9,106	37,951	4.16	19	8,402	51,028	6.07
Granite	580	145,254	669,807	4.61	737	179,972	900,682	5.00
Traprock	644	83,548	388,027	4.64	813	103,413	505,187	4.89
Sandstone and quartzite	378	23,148	103,483	4.47	523	32,495	157,934	4.86
Slate	7	773	3,758	4.86	10	2,330	14,258	6.12
Volcanic cinder and scoria	256	2,953	12,504	4.23	359	3,657	14,952	4.09
Miscellaneous stone	81	13,269	56,875	4.29	394	19,027	77,954	4.10
Total[1]	XX	1,000,800	4,053,600	4.05	XX	1,200,100	5,248,600	4.37

XX Not applicable.
[1]Data may not add to totals shown because of independent rounding.

Table 3.—Crushed stone[1] sold or used in the United States, by region

(Thousand short tons and thousand dollars)

Region	1986[e]		1987	
	Quantity	Value	Quantity	Value
Northeast:				
New England	23,700	119,500	34,500	203,581
Middle Atlantic	119,600	609,100	153,782	767,445
Midwest:				
East North Central	152,600	544,900	195,622	804,954
West North Central	107,200	385,700	118,759	431,975
South:				
South Atlantic	275,600	1,252,700	315,991	1,510,541
East South Central	104,700	438,000	126,245	556,353
West South Central	136,400	488,700	129,613	465,909
West:				
Mountain	31,700	119,000	38,121	147,323
Pacific	71,700	297,400	87,497	360,517
Total[2]	1,023,200	4,255,000	1,200,100	5,248,600

[e]Estimated.
[1]Includes volcanic cinder and scoria.
[2]Data may not add to totals shown because of independent rounding.

Table 4.—Crushed stone sold or used by producers in the United States, by State[1]

(Thousand short tons and thousand dollars)

State	1986[e]		1987	
	Quantity	Value	Quantity	Value
Alabama	24,000	120,500	30,018	146,247
Alaska	2,000	8,500	2,033	8,945
Arizona	5,600	25,100	7,712	33,999
Arkansas	15,500	58,500	15,234	63,847
California	38,500	159,300	44,315	186,504
Colorado	8,000	30,700	8,045	33,465
Connecticut	7,700	45,800	11,412	76,668
Florida	69,000	288,200	[2]78,992	[2]350,537
Georgia	56,700	295,100	60,834	318,903
Hawaii	7,100	42,100	5,732	41,548
Idaho	3,700	12,700	3,852	15,346
Illinois	44,200	179,600	52,102	216,212
Indiana	[2]22,600	[2]76,500	31,667	106,770
Iowa	23,400	98,000	25,991	119,166
Kansas	16,600	60,500	19,319	69,628
Kentucky	[3]38,400	[3]137,000	43,330	173,222

See footnotes at end of table.

Table 4.—Crushed stone sold or used by producers in the United States, by State[1] —Continued

(Thousand short tons and thousand dollars)

State	1986[e]		1987	
	Quantity	Value	Quantity	Value
Louisiana[4]	5,400	25,300	4,390	36,514
Maine	1,600	4,400	2,010	7,532
Maryland	26,400	126,000	30,136	151,579
Massachusetts	10,000	50,000	14,907	78,969
Michigan	27,800	83,900	37,909	109,514
Minnesota	8,300	26,300	8,995	29,246
Mississippi	1,600	4,400	1,492	9,621
Missouri	51,200	170,500	54,910	184,824
Montana	[5]2,200	[5]6,200	1,463	3,585
Nebraska	4,000	17,900	4,316	19,461
Nevada	1,500	7,000	[6]1,264	[6]5,700
New Hampshire	1,800	5,900	2,479	10,386
New Jersey	15,300	95,400	[7]17,576	[7]111,951
New Mexico	3,900	15,300	4,503	15,919
New York	40,600	196,600	38,103	188,694
North Carolina	43,500	206,500	48,847	237,181
North Dakota	W	W	W	W
Ohio	39,300	147,300	51,580	300,696
Oklahoma	30,900	102,100	[8]25,155	[8]83,732
Oregon	15,100	53,400	20,663	73,902
Pennsylvania	63,700	317,100	97,213	458,676
Rhode Island	[4]1,000	[4]5,700	1,228	7,797
South Carolina	18,200	76,700	[8]24,278	[8]105,387
South Dakota	3,600	12,600	5,070	18,515
Tennessee	[9]40,700	[9]175,600	51,406	227,263
Texas	84,200	301,500	84,347	276,477
Utah	4,500	14,100	7,989	23,606
Vermont	1,600	7,600	[9]2,159	[9]20,400
Virginia	52,000	224,700	60,376	295,903
Washington	9,000	34,100	14,754	49,618
West Virginia	9,800	37,500	12,458	50,947
Wisconsin	18,700	57,600	[5]22,757	[5]71,776
Wyoming	[9]1,700	[8]5,900	3,171	15,049
Other	1,100	4,000	2,230	16,831
Total[10]	1,023,200	4,255,000	1,200,100	5,248,600

[e]Estimated. W Withheld to avoid disclosing company proprietary data; included with "Other."

[1]To avoid disclosing company proprietary data, certain State totals do not include all kinds of stone produced within the State; the portion not shown has been included with "Other."

[2]Excludes marl.

[3]Excludes sandstone.

[4]Excludes other stone.

[5]Excludes traprock.

[6]Excludes dolomite.

[7]Excludes limestone.

[8]Excludes shell.

[9]Excludes granite.

[10]Data may not add to totals shown because of independent rounding.

Table 5.—U.S. crushed stone sold or used by producers in 1987, by size of operation

Size range (Thousand short tons)	Number of operations	Quantity (thousand short tons)	Percent
0 to 25	764	7,262	0.6
25 to 50	331	12,110	1.0
50 to 75	248	15,561	1.3
75 to 100	197	17,323	1.5
100 to 200	525	77,276	6.4
200 to 300	332	81,583	6.8
300 to 400	192	67,500	5.6
400 to 500	168	75,341	6.3
500 to 600	111	61,700	5.1
600 to 700	116	74,990	6.3
700 to 800	78	58,926	4.9
800 to 900	76	65,177	5.4
900 to 999	44	41,522	3.5
1,000 to 1,999	207	277,373	23.1
2,000 and over	84	266,485	22.2
Total	3,473	[1]1,200,100	100

[1]Data do not add to total shown because of independent rounding.

Table 6.—Crushed limestone and dolomite sold or used in the United States in 1987, by State

(Thousand short tons and thousand dollars)

State	Limestone		Dolomite	
	Quantity	Value	Quantity	Value
Alabama	24,155	100,413	4,753	21,705
Alaska	W	W		
Arizona	3,748	15,977		
Arkansas	3,726	14,349	1,483	W
California	20,226	77,126	386	6,011
Colorado	2,565	10,701		
Connecticut	377	2,350		
Florida	72,184	329,011	1,128	7,481
Georgia	W	W	W	W
Hawaii	1,337	9,093		
Idaho	373	1,034	[1]	[1]
Illinois	49,883	207,185	2,154	8,539
Indiana	29,549	101,000	1,486	5,658
Iowa	25,991	110,106		
Kansas	18,788	66,306		
Kentucky	W	W	W	W
Maine	1,509	4,395		
Maryland	18,793	94,102		
Massachusetts	1,739	10,019		
Michigan	32,180	91,508	5,588	17,578
Minnesota	W	W	W	W
Mississippi	1,492	9,621		
Missouri	51,680	174,925	1,151	4,505
Montana	1,244	2,803		
Nebraska	4,316	19,461		
Nevada	W	W	W	W
New Jersey	W	W		
New Mexico	3,150	10,263		
New York	26,052	113,576	3,723	18,602
North Carolina	4,242	22,414		
Ohio	48,181	286,479	3,243	13,183
Oklahoma	W	W	W	W
Oregon	W	W		
Pennsylvania	58,274	288,608	15,455	59,103
Rhode Island	678	4,866		
South Carolina	5,980	24,670		
South Dakota	3,872	11,408		
Tennessee	W	W	W	W
Texas	79,684	251,792	1,328	3,678
Utah	W	W	W	W
Vermont	1,807	8,065		
Virginia	19,622	87,616	2,112	16,255
Washington	689	2,400	415	1,093
West Virginia	10,737	39,586		
Wisconsin	18,175	58,477	1,075	2,420
Wyoming	W	W	W	W
Other	145,452	588,009	3,165	21,093
Total[2]	792,450	3,249,700	48,650	206,900

W Withheld to avoid disclosing company proprietary data; included with "Other."
[1]Less than 1/2 unit.
[2]Data may not add to totals shown because of independent rounding.

Table 7.—Crushed calcareous marl sold or used by producers in the United States in 1987, by State

(Thousand short tons and thousand dollars)

State	Quantity	Value
Florida	W	W
Indiana	W	W
Maine	W	W
Michigan	20	67
North Carolina	31	156
South Carolina	3,355	6,089
Texas	W	W
Other	748	1,338
Total	4,154	7,650

W Withheld to avoid disclosing company proprietary data; included with "Other."

Table 8.—Crushed granite, traprock, and sandstone and quartzite sold or used by producers in the United States in 1987, by State

(Thousand short tons and thousand dollars)

State	Granite		Traprock		Sandstone and quartzite	
	Quantity	Value	Quantity	Value	Quantity	Value
Alabama	W	W				
Alaska	511	1,966	635	2,718	W	W
Arizona	3,014	13,636			W	W
Arkansas	5,826	26,784			4,608	16,432
California	9,890	40,362	8,017	40,403	2,736	9,755
Colorado	4,565	19,126			151	628
Connecticut	W	W	10,958	73,607		
Georgia	47,204	247,555			2,682	11,383
Hawaii			4,139	31,160		
Idaho	172	814	2,684	9,151	621	4,347
Illinois					66	488
Indiana					W	W
Kansas					531	3,322
Kentucky					W	W
Louisiana					14	97
Maine			W	W	W	W
Maryland	3,104	16,504	3,188	11,986	267	1,690
Massachusetts	2,199	16,858	9,960	45,681	W	W
Michigan			W	1	W	W
Minnesota	W	W	W	W	W	W
Missouri	W	W				
Montana			W	W	112	534
Nevada	31	48				
New Hampshire	1,002	4,950	1,477	5,448		
New Jersey	5,964	42,510	11,612	69,441		
New Mexico	W	W	223	W	W	W
New York	W	W	3,178	23,331	1,050	6,042
North Carolina	28,665	183,868	3,058	15,931	W	W
Ohio					165	434
Oklahoma	1,176	4,804			350	1,261
Oregon	351	1,179	16,331	57,784	1,166	4,704
Pennsylvania	W	W	7,669	35,714	8,438	44,289
Rhode Island	504	W	W	W		
South Carolina	14,943	74,629				
South Dakota	W	W			1,195	6,451
Texas			W	W	1,614	9,853
Utah	W	W			544	1,647
Vermont	W	W				
Virginia	26,824	137,584	7,703	39,852	1,185	4,954
Washington	633	2,655	11,491	37,675	984	5,451
West Virginia					1,721	11,961
Wisconsin	1,874	6,266	W	W	1,634	4,614
Wyoming	W	W				
Other	11,548	58,612	1,050	5,304	1,405	10,178
Total[1]	180,000	980,700	103,400	505,200	32,500	157,900

W Withheld to avoid disclosing company proprietary data; included with "Other."
[1]Data may not add to totals shown because of independent rounding.

Table 9.—Volcanic cinder and scoria and miscellaneous crushed stone sold or used by producers in the United States in 1987, by State

(Thousand short tons and thousand dollars)

State	Volcanic cinder and scoria		Miscellaneous stone	
	Quantity	Value	Quantity	Value
Alaska			111	610
Arizona	845	3,277	43	W
Arkansas			153	956
California	480	2,137	1,095	3,361
Colorado	93	665	729	2,345
Florida			2,266	3,815
Hawaii	255	1,294	1	1
Louisiana			W	W
Maryland			W	W
Massachusetts			W	W
Montana	18	18		
Nevada	222	1,046	12	12
New Mexico	113	310	W	W
Oregon	860	2,833	766	2,328

See footnote at end of table.

Table 9.—Volcanic cinder and scoria and miscellaneous crushed stone sold or used by producers in the United States in 1987, by State —Continued

(Thousand short tons and thousand dollars)

State	Volcanic cinder and scoria		Miscellaneous stone	
	Quantity	Value	Quantity	Value
Pennsylvania			6,749	27,953
Tennessee			W	W
Texas			269	1,942
Utah	100	412	[1]	2
Virginia			W	W
Washington	80	411	554	1,933
Other[2]	581	2,610	6,280	32,697
Total[3]	3,700	15,000	19,000	78,000

W Withheld to avoid disclosing company proprietary data; included with "Other."
[1]Less than 1/2 unit.
[2]Includes data for North Carolina, North Dakota, and Wyoming.
[3]Data may not add to totals shown because of independent rounding.

Table 10.—Kind of crushed stone produced in the United States in 1987, by State

State	Limestone	Dolomite	Marble	Marl	Shell	Granite	Traprock	Sandstone	Quartzite	Slate	Volcanic cinder and scoria	Miscellaneous
Alabama	X	X	X			X						
Alaska	X				X	X	X	X				X
Arizona	X		X			X		X			X	X
Arkansas	X	X				X		X		X		X
California	X	X	X		X	X	X	X	X	X	X	X
Colorado	X					X		X			X	X
Connecticut	X					X	X					
Florida	X	X		X	X							X
Georgia	X	X	X			X			X	X		
Hawaii	X						X				X	X
Idaho	X	X				X	X	X	X			
Illinois	X	X						X				
Indiana	X	X		X				X				
Iowa	X											
Kansas	X							X	X			
Kentucky	X	X						X				
Louisiana					X			X				X
Maine	X			X			X		X			
Maryland	X				X	X	X	X	X			X
Massachusetts	X					X	X	X				X
Michigan	X	X		X			X		X			
Minnesota	X	X				X	X	X	X			
Mississippi	X											
Missouri	X	X				X						
Montana	X						X	X	X		X	
Nebraska	X											
Nevada	X	X	X			X					X	X
New Hampshire						X	X					
New Jersey	X					X	X					
New Mexico	X		X			X	X		X		X	X
New York	X	X	X			X	X	X		X		
North Carolina	X			X		X	X		X	X	X	X
North Dakota											X	X
Ohio	X	X						X				
Oklahoma	X	X				X		X				
Oregon	X					X	X	X	X		X	X
Pennsylvania	X	X				X	X	X	X			
Rhode Island	X					X	X					
South Carolina	X			X	X	X						
South Dakota	X					X		X	X			

| | | |

CONSUMPTION AND USES

Crushed stone production reported to the Bureau of Mines is actually material that was either sold or used by the producers. Stockpiled production is not reported. Therefore, the sold or used tonnage represented the amount of production released for domestic consumption or export in a given year. Because some of the crushed stone producers did not report a breakdown by end use, their total production, as well as the estimated production of nonrespondents, was included in the tables under "Other unspecified uses" starting with the 1983 survey. This change in the processing procedures should be taken into account when 1983 through 1987 use patterns are compared with prior years.

In 1987, U.S. consumption of crushed stone was 1.2 billion tons valued at $5.2 billion, a 17.3% increase over the estimated consumption of 1986, and a 19.9% increase over the reported consumption of 1985. About 55% of this tonnage was used as construction aggregates, mostly for highway and road construction and maintenance, 9% for cement and lime manufacturing, 2% for agricultural purposes, 2% for a variety of industrial uses, and 32% for other unspecified uses. No significant changes occurred in the use patterns of crushed stone at the national level except for the large increase in the amount included under "Other unspecified uses."

Limestone.—Of the 792 million tons of crushed limestone consumed, 50% was used as construction aggregates, 13% for cement and lime manufacturing, and 3% for agricultural purposes. Owing to the significant increase in the amount of limestone included under "Other unspecified uses," from 138 million tons in 1985 to 261 million tons in 1987, a meaningful comparison of changes in the consumption of limestone by uses between 1985 and 1987 cannot be made. It is recommended that with any such comparison, the quantities and values included with "Other unspecified uses" be distributed among the reported uses being analyzed based on the following calculation: The percentage for each reported use should be calculated as a percentage of the U.S. total minus "Other unspecified uses"; the resulting percentages then should be applied to "Other unspecified uses" and the resulting quantities and values added to the reported uses published in the table.

Dolomite.—Of the 49 million tons of crushed dolomite consumed, 66% was used as construction aggregates, 3% as agricultural lime, 3% as flux stone, 1% for lime manufacturing, and 25% for other unspecified uses. An additional undefined amount of dolomite consumed in a variety of uses is reported with the limestone.

Marble.—Of the 5.6 million tons of crushed marble consumed, 25% was used as fillers and extenders, 9% was used for construction purposes, and 42% was used for other unspecified uses.

Calcareous Marl.—Of the 4.2 million tons of marl consumed, 98% was used for cement manufacturing and 1% was used for agricultural purposes.

Shell.—Of the 8.4 million tons of crushed shell consumed, 37% was used as construction aggregates and 62% for other unspecified uses.

Granite.—Of the 180 million tons of crushed granite consumed, 76% was used as construction aggregates, 5% was used as railroad ballast, and 19% was used for other unspecified uses.

Traprock.—Of the 103 million tons of crushed traprock consumed, 50% was used as construction aggregates, less than 2% was used as railroad ballast, and 48% was used for other unspecified uses.

Sandstone and Quartzite.—Of the 32 million tons of combined crushed sandstone and quartzite consumed, 60% was used as construction aggregates, 2% as railroad ballast, 1% for cement manufacturing, and 36% for other unspecified uses.

Slate.—Of the 2.3 million tons of crushed slate consumed, 63% was used for a variety of industrial applications and 37% was used as construction aggregates.

Volcanic Cinder and Scoria.—Of the 3.7 million tons of volcanic cinder and scoria consumed, 43% was used as construction aggregates, mainly for road construction and maintenance, and 52% was used for other unspecified uses.

Miscellaneous Stone.—Of the 19 million tons of miscellaneous crushed stone consumed, 71% was used as construction aggregates and 29% for other unspecified uses.

Table 11.—Crushed stone sold or used by producers in the United States in 1987, by use

(Thousand short tons and thousand dollars)

Use	Quantity	Value
Coarse aggregate (+ 1-1/2 inch):		
Macadam	10,688	44,007
Riprap and jetty stone	24,353	108,056
Filter stone	6,497	27,579
Other coarse aggregate	2,367	9,641
Coarse aggregate, graded:		
Concrete aggregate, coarse	109,699	504,936
Bituminous aggregate, coarse	72,626	339,956
Bituminous surface-treatment aggregate	25,148	116,471
Railroad ballast	16,471	67,761
Other graded coarse aggregate	7,138	31,841
Fine aggregate (-3/8 inch):		
Stone sand, concrete	19,540	100,339
Stone sand, bituminous mix or seal	19,037	85,858
Screening, undesignated	25,328	101,448
Other fine aggregate	1,194	6,300
Coarse and fine aggregates:		
Graded road base or subbase	194,872	717,359
Unpaved road surfacing	30,451	117,108
Terrazzo and exposed aggregate	2,438	11,956
Crusher run or fill or waste	63,670	263,986
Other coarse and fine aggregates	5,477	16,610
Other construction materials[1]	28,279	149,892
Agricultural:		
Agricultural limestone	20,602	93,869
Poultry grit and mineral food	2,047	20,511
Other agricultural uses	391	2,553
Chemical and metallurgical:		
Cement manufacture	93,233	270,317
Lime manufacture	13,047	64,466
Dead-burned dolomite manufacture	650	5,429
Flux stone	5,998	28,438
Chemical stone	207	1,365
Glass manufacture	755	6,642
Sulfur oxide removal	1,550	7,458
Special:		
Mine dusting or acid water treatment	774	7,185
Asphalt fillers or extenders	1,634	11,827
Whiting or whiting substitute	403	12,234
Other fillers or extenders	5,182	88,149
Roofing granules	1,672	8,717
Other miscellaneous uses[3]	4,742	31,078
Other unspecified uses[2]	381,969	1,767,256
Total[4]	1,200,100	5,248,600

[1]Includes dam construction and drain fields.
[2]Includes stone used in chemicals, disinfectant and animal sanitation, and refractory stone (including ganister).
[3]Includes production reported without a breakdown by use and estimates for nonrespondents.
[4]Data may not add to totals shown because of independent rounding.

Table 12.—Crushed limestone and dolomite sold or used by

(Thousand short tons)

State	Concrete aggregate		Bituminous aggregate		Roadstone and coverings		Riprap and railroad ballast	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Alabama	5,054	21,577	4,633	16,868	2,863	10,773	1,079	4,030
Alaska	—	—	—	—	W	W	—	—
Arizona	W	W	W	W	W	W	—	—
Arkansas	188	787	364	W	929	3,401	488	1,839
California	W	W	W	W	525	1,123	W	W
Colorado	—	—	W	W	W	W	—	—
Connecticut	—	—	—	—	—	—	—	—
Florida	21,136	114,768	8,262	43,101	13,394	40,212	257	1,210
Georgia	1,220	6,741	1,511	7,478	2,525	13,242	79	382
Hawaii	259	2,524	—	—	215	1,658	—	—
Idaho	—	—	—	—	50	125	—	—
Illinois	4,969	19,765	6,025	27,874	16,196	58,860	1,252	6,167
Indiana	3,704	10,774	3,423	11,141	3,789	13,516	1,684	6,217
Iowa	1,942	9,338	3,873	17,871	4,905	18,256	116	505
Kansas	1,435	6,387	1,457	6,382	3,904	13,257	390	1,794
Kentucky	3,670	13,377	5,772	22,406	8,510	32,326	1,843	7,150
Maine	W	W	—	—	—	—	—	—
Maryland	1,175	4,996	527	2,694	700	3,124	177	792
Massachusetts	W	W	W	W	—	—	—	—
Michigan	1,604	4,423	609	1,540	4,130	12,389	265	1,251
Minnesota	365	1,042	504	1,721	3,667	11,545	156	611
Mississippi	W	W	W	W	W	W	W	W
Missouri	4,502	17,304	3,463	13,508	10,288	36,208	3,604	11,540
Montana	—	—	—	—	—	—	—	—
Nebraska	1,516	6,877	W	W	696	3,362	78	417
Nevada	—	—	—	—	—	—	—	—
New Jersey	W	W	W	W	W	W	—	—
New Mexico	256	529	74	220	736	2,696	290	1,555
New York	2,150	11,317	5,572	26,782	3,583	16,846	999	5,938
North Carolina	523	2,887	W	W	912	4,749	W	W
Ohio	2,912	10,349	2,213	8,883	13,112	45,217	1,049	4,034
Oklahoma	1,826	6,496	784	3,184	956	2,465	167	604
Oregon	—	—	—	—	—	—	—	—
Pennsylvania	5,411	25,703	11,600	48,802	11,493	49,484	425	2,011
Rhode Island	—	—	—	—	—	—	—	—
South Carolina	719	3,696	482	2,197	1,788	4,506	W	W
South Dakota	W	W	139	533	W	W	125	559
Tennessee	5,346	24,630	8,723	37,101	8,899	36,306	453	1,889
Texas	11,561	45,334	8,201	36,820	27,177	60,964	863	4,374
Utah	—	—	—	—	20	40	3,230	W
Vermont	—	—	—	—	W	W	—	—
Virginia	3,393	15,670	2,222	10,623	3,947	15,103	814	3,595
Washington	—	—	22	104	1	3	4	18
West Virginia	641	2,289	455	1,897	330	1,340	63	281
Wisconsin	1,139	3,856	1,195	3,404	7,229	20,903	243	1,857
Wyoming	313	951	540	1,976	199	660	303	1,119
Total (excluding withheld)	88,930	394,386	82,645	355,212	157,667	534,658	543,084	70,837
Total withheld	1,703	6,578	1,271	8,193	2,273	8,426	W	8,277
Grand total[1]	90,633	400,964	83,916	363,405	159,940	543,084	20,494	79,114
Guam	W	620	—	—	W	W	W	10
Puerto Rico	941	4,753	75	411	W	W	W	W

W Withheld to avoid disclosing company proprietary data; included with "Total withheld" and "Other uses."
[1]Data may not add to totals shown because of independent rounding.
[2]Less than 1/2 unit.

producers in the United States in 1987, by State and use

and thousand dollars)

Other construction uses		Cement manufacture		Agricultural uses		Lime manufacture		Other uses		Total[1]	
Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
4,054	15,813	3,795	11,088	733	4,658	1,595	5,742	5,163	31,569	28,908	122,119
(2)	1							W	W	W	W
W	W	2,116	7,819					1,632	8,158	3,748	15,977
177	538	W	W	169	1,181	W	W	2,896	11,698	5,210	19,443
W	W	17,076	51,368	W	W	W	W	3,021	30,647	20,622	83,137
W	W	W	W	W	W	W	W	2,565	10,701	2,565	10,701
W	44			W	247			377	2,069	377	2,359
10,609	35,548	1,985	8,002	1,091	7,351			16,577	86,380	73,312	336,492
822	4,590	W	W	W	W			4,444	19,946	10,600	52,377
W	W	746	4,252	W	W			117	659	1,337	9,093
		W	W	25	74			298	935	373	1,034
1,947	7,027	1,762	4,999	4,639	16,367	W	W	15,246	74,665	52,035	215,724
2,267	8,169	3,584	10,092	2,659	8,103			10,524	39,646	31,035	106,658
1,814	7,803	2,811	7,385	2,546	15,931	W	W	7,985	33,017	25,991	110,106
1,927	7,146	3,001	8,058	291	795			6,585	22,489	18,788	66,306
2,924	10,195	W	W	1,686	6,267	W	W	18,834	81,196	43,239	172,916
		W	W	W	W			1,509	4,395	1,509	4,395
1,472	6,660	2,660	7,914			W	W	12,082	67,923	18,793	94,102
320	2,020			W	W	W	W	1,419	7,999	1,739	10,019
347	1,100	5,386	9,053	212	1,084	3,528	W	21,687	78,246	37,769	109,086
356	1,470			250	851			2,084	6,816	7,381	24,077
W	W			124	662			1,368	8,960	1,492	9,621
2,856	12,217	3,103	7,552	1,881	6,063	W	W	23,033	75,037	52,852	179,430
		W	W					1,244	2,803	1,244	2,803
762	4,154	W	W	329	2,069			936	2,592	4,316	19,461
		W	W	W	W	W	W	1,121	5,247	1,121	5,247
W	W			W	W			W	W	W	W
1,050	3,189	W	W					733	2,073	3,150	10,263
2,905	11,773	4,019	9,802	123	948			10,425	49,672	29,776	132,178
2,341	13,147			W	W			466	1,631	4,242	22,414
2,053	6,793	1,538	3,913	1,437	6,464	W	1,423	27,119	212,587	51,424	299,662
1,986	4,136	2,525	4,696	79	224			15,587	59,513	23,911	81,318
W	W	W	W					W	W	W	W
7,785	26,758	7,427	31,590	1,144	11,124	1,620	11,972	26,824	140,168	73,729	347,711
				16	W			562	4,866	678	4,866
1,844	8,929			W	W			1,147	6,242	5,980	24,670
74	309	W	W			W	W	3,533	10,016	3,872	11,408
10,484	42,475	W	W	1,265	4,910	W	W	16,196	79,779	51,366	227,090
2,636	5,930	9,247	20,595	326	949	724	2,995	29,276	77,509	81,012	255,470
		1,438	4,352	6	98	W	W	1,758	14,011	6,453	18,501
W	W							1,807	8,065	1,807	8,065
3,876	14,083	1,114	6,798	713	6,605	W	W	5,656	31,395	21,734	103,871
5	71			7	32			1,066	3,265	1,103	3,493
1,143	5,129	W	W	33	318			8,973	28,331	10,737	39,586
513	1,123	W	W	879	4,472	W	W	8,052	25,281	19,249	60,896
119	458	W	W					226	525	1,698	5,689
71,573	267,889	75,331	219,325	22,064	107,846	7,408	22,132	312,144	1,467,523	838,258	3,439,806
1,350	6,616	11,456	33,752	819	7,742	6,284	47,671	2,848	16,811	2,848	16,812
72,923	274,505	86,787	253,077	22,883	115,588	13,692	69,803	XX	XX	841,100	3,456,600
W	W								W	355	2,289
W	W	W	5,902						13,154	5,377	24,221

XX Not applicable.

Table 13.—Crushed limestone and dolomite sold or used by producers in the United States in 1987, by use

(Thousand short tons and thousand dollars)

Use	Limestone		Dolomite	
	Quantity	Value	Quantity	Value
Coarse aggregate (+ 1-1/2 inch):				
Macadam	8,041	30,428	169	745
Riprap and jetty stone	14,945	55,614	487	2,014
Filter stone	4,526	17,886	171	651
Other coarse aggregate	1,191	4,742	697	2,415
Coarse aggregate, graded:				
Concrete aggregate, coarse	71,095	306,531	4,290	20,093
Bituminous aggregate, coarse	45,749	198,658	3,750	17,551
Bituminous surface-treatment aggregate	16,992	73,756	1,075	4,262
Railroad ballast	4,232	16,550	1,099	4,936
Other graded coarse aggregate	568	2,299	3,400	10,838
Fine aggregate (-3/8 inch):				
Stone sand, concrete	13,569	65,116	1,073	6,358
Stone sand, bituminous mix or seal	9,581	39,950	1,302	5,150
Screenings, undesignated	16,866	64,427	430	1,102
Other fine aggregate	607	2,867	--	--
Coarse and fine aggregates:				
Graded road base or subbase	117,348	385,981	7,676	27,615
Unpaved road surfacing	24,200	88,732	616	2,426
Terrazzo and exposed aggregate	590	1,938	[1]	[1]
Crusher run, fill or waste	33,638	126,501	2,112	8,264
Other coarse and fine aggregates	1,304	4,472	3,016	7,418
Other construction materials[2]	9,265	36,722	339	1,553
Agricultural:				
Agricultural limestone	19,081	82,679	1,521	11,190
Poultry grit and mineral food	1,958	19,993	--	--
Other agricultural uses	218	1,493	29	159
Chemical and metallurgical:				
Cement manufacture	87,792	255,467	--	--
Lime manufacture	12,499	62,071	542	2,303
Dead-burned dolomite manufacture	67	716	W	W
Flux stone	4,498	20,887	1,237	5,102
Chemical stone	189	1,287	W	W
Glass manufacture	755	6,642	--	--
Sulfur oxide removal	1,550	7,458	--	--
Special:				
Mine dusting or acid water treatment	691	6,273	W	W
Asphalt fillers or extenders	1,495	10,921	W	19
Whiting or whiting substitute	213	7,221	W	114
Other fillers or extenders	3,513	53,727	147	1,683
Roofing granules	206	1,744	8	23
Paper manufacture	W	W	--	--
Other miscellaneous uses[3]	2,463	15,962	1,208	8,021
Other unspecified uses[4]	260,953	1,172,003	12,259	54,901
Total[5]	792,450	3,249,700	48,650	206,900

W Withheld to avoid disclosing company proprietary data; included with "Other miscellaneous uses."
[1]Included with "Other construction materials."
[2]Includes stone used in dam construction and drain fields.
[3]Includes stone used in chemicals, disinfectant and animal sanitation, waste material, and data indicated by symbol W.
[4]Includes production reported without a breakdown by use and estimates for nonrespondents.
[5]Data may not add to totals shown because of independent rounding.

Table 14.—Crushed marble sold or used by producers in the United States in 1987, by use

(Thousand short tons and thousand dollars)

Use	Quantity	Value
Coarse aggregate, graded	12	100
Fine aggregate (-3/8 inch):		
Screenings, undesignated	2	36
Other fine aggregate	3	25
Coarse and fine aggregates:		
Graded road base or subbase	373	W
Terrazzo and exposed aggregate	80	1,594
Crusher run or fill or waste	15	73
Other construction materials[1]	27	2,110
Chemical and metallurgical: Lime manufacture	5	92
Special: Whiting or whiting substitute and fillers	1,530	37,031
Other miscellaneous uses[2]	1,195	7,950
Other unspecified uses[3]	2,335	14,304
Total[4]	5,600	62,300

W Withheld to avoid disclosing company proprietary data; included with "Other unspecified uses."
[1]Includes other coarse and fine aggregates, riprap and jetty stone, and stone sand.
[2]Includes agricultural stone, cement manufacture, and roofing granules.
[3]Includes production reported without a breakdown by use, estimates for nonrespondents, and data indicated by symbol W.
[4]Data may not add to totals shown because of independent rounding.

Table 15.—Crushed granite and traprock sold or used by producers in the United States in 1987, by use

(Thousand short tons and thousand dollars)

Use	Granite		Traprock	
	Quantity	Value	Quantity	Value
Coarse aggregate (+1-1/2 inch):				
Macadam	1,185	6,115	456	2,701
Riprap and jetty stone	5,008	30,641	2,293	10,765
Filter stone	1,180	5,522	254	1,512
Other coarse aggregate			326	2,087
Coarse aggregate, graded:				
Concrete aggregate, coarse	23,589	123,865	6,561	34,235
Bituminous aggregate, coarse	15,722	85,549	4,941	25,870
Bituminous surface-treatment aggregate	3,609	19,995	1,962	10,108
Railroad ballast	8,692	34,502	1,682	7,290
Other graded coarse aggregate	40	126	2,746	17,543
Fine aggregate (-3/8 inch):				
Stone sand, concrete	2,990	13,788	613	8,129
Stone sand, bituminous mix or seal	5,447	26,366	1,300	6,499
Screening, undesignated	6,717	30,781	231	1,025
Other fine aggregate	267	1,408	298	1,920
Coarse and fine aggregates:				
Graded road base or subbase	34,814	159,063	21,016	84,777
Unpaved road surfacing	1,555	7,533	2,605	10,319
Terrazzo and exposed aggregate	859	3,560	62	358
Crusher run or fill or waste	20,471	98,868	3,156	13,270
Other coarse and fine aggregates	48	126	736	3,538
Other construction materials	13,236	83,122	2,225	14,201
Other miscellaneous uses[1]	1,144	5,235	650	3,341
Other unspecified uses[2]	33,398	164,577	49,298	245,699
Total[3]	180,000	900,700	103,400	505,200

[1]Includes roofing granules, granite used in poultry grit and mineral food, and traprock.
[2]Includes production reported without a breakdown by end use and estimates for nonrespondents.
[3]Data may not add to totals shown because of independent rounding.

Table 16.—Crushed sandstone and quartzite sold or used by producers in the United States in 1987, by use

(Thousand short tons and thousand dollars)

Use	Sandstone		Quartzite	
	Quantity	Value	Quantity	Value
Coarse aggregate (+1-1/2 inch):				
Macadam	325	1,146		
Riprap and jetty stone	1,096	5,736	125	619
Filter stone	227	1,417	14	101
Other coarse aggregate	6	114		
Coarse aggregate, graded:				
Concrete aggregate, coarse	1,716	9,665	1,123	5,396
Bituminous aggregate, coarse	1,952	9,834	256	1,181
Bituminous surface-treatment aggregate	673	3,923	186	725
Railroad ballast	292	1,857	400	2,191
Other graded coarse aggregate	72	396		
Fine aggregate (-3/8 inch):				
Stone sand, bituminous mix or seal	1,126	6,111	357	1,636
Screening, undesignated	938	5,832	20	64
Other fine aggregate	704	2,229		
Coarse and fine aggregates:				
Graded road base or subbase	5,430	23,584	911	4,299
Unpaved road surfacing	346	1,647	69	295
Terrazzo and exposed aggregate	82	625		
Crusher run or fill or waste	1,011	4,909	3	11
Other construction materials	424	2,265	504	2,892
Chemical and metallurgical:				
Cement manufacture	197	842	139	971
Flux stone			262	2,449
Special:				
Asphalt fillers or extenders	20	W		
Refractory stone			25	79
Other fillers or extenders			1	15
Other miscellaneous uses[1]	69	806		
Other unspecified uses[2]	10,101	46,204	970	5,841
Total[3]	27,100	129,100	5,400	28,900

W Withheld to avoid disclosing company proprietary data; included with "Other miscellaneous uses."
[1]Includes stone used in poultry grit and mineral food and data indicated by symbol W.
[2]Includes production reported without a breakdown by end use and estimates for nonrespondents.
[3]Data may not add to totals shown because of independent rounding.

Table 17.—Crushed volcanic cinder and scoria sold or used by producers in the United States in 1987, by use

(Thousand short tons and thousand dollars)

Use	Quantity	Value
Coarse aggregate (+1-1/2 inch): Riprap and jetty stone	8	40
Concrete aggregate, graded: Concrete aggregate, coarse	206	927
Coarse and fine aggregates:		
Graded road base or subbase	426	1,951
Unpaved road surfacing	212	1,062
Terrazzo and exposed aggregate	297	1,567
Crusher run or fill or waste	65	670
Other construction materials[1]	278	954
Other miscellaneous uses[2]	157	599
Other unspecified uses[3]	1,908	7,161
Total[4]	3,700	15,000

[1]Includes railroad ballast, bituminous aggregate (coarse), fine aggregate, stone sand, and screening.
[2]Includes roofing granules and a minor amount of stone used for agricultural purposes.
[3]Includes production reported without a breakdown by use and estimates for nonrespondents.
[4]Data may not add to totals shown because of independent rounding.

Table 18.—Crushed miscellaneous stone[1] sold or used by producers in the United States in 1987, by use

(Thousand short tons and thousand dollars)

Use	Quantity	Value
Coarse aggregate (+1-1/2 inch):		
Macadam	511	2,832
Riprap and jetty stone	196	2,259
Other coarse aggregate	83	217
Coarse aggregate, graded:		
Concrete aggregate, coarse	929	4,375
Bituminous aggregate, coarse	231	1,118
Bituminous surface-treatment aggregate	630	3,551
Other graded coarse aggregate	300	628
Fine aggregate (-3/8 inch):		
Stone sand, concrete	134	536
Stone sand, bituminous mix or seal	112	425
Coarse and fine aggregates:		
Graded road base or subbase	6,878	28,650
Unpaved road surfacing	846	5,073
Terrazzo and exposed aggregate	105	510
Crusher run or fill	2,898	11,389
Other coarse and fine aggregates	358	797
Other construction materials[2]	3,998	16,243
Agricultural: Other agricultural purposes	75	409
Chemical and metallurgical: Cement manufacture	4,651	7,238
Other miscellaneous uses[3]	1,553	8,524
Other unspecified uses[4]	10,724	56,116
Total[5]	33,900	150,900

[1]Includes marl, other stone, shell, and slate.
[2]Includes filter stone, lightweight aggregate, railroad ballast, and undesignated screenings.
[3]Includes fillers or extenders and roofing granules.
[4]Includes production reported without a breakdown by end use and estimates for nonrespondents.
[5]Data may not add to totals shown because of independent rounding.

PRICES

Compared with that of 1985, the 1987 average unit price of crushed stone increased 8% to $4.37. By kind of stone, the average unit prices showed increases of 46% for shell, 33% for marble, 26% for slate, 9% for granite and sandstone and quartzite, 7% for limestone, and 5% for traprock. At the same time, the average unit prices decreased by 10% for marl, 4% for miscellaneous stone, and 3% for volcanic cinder and scoria. Despite the increase in the reported output of crushed dolomite in 1987, the average unit price remained unchanged at $4.25.

TRANSPORTATION

Of the total crushed stone produced, 51% was transported by truck from the processing plant or quarry to the first point of sale or use, 4% was transported by rail, and 3% by waterway. For about 40% of the total crushed stone produced in 1987 no means of transportation was reported by the producers or the production was used on-site.

Table 19.—Crushed stone sold or used by producers in the United States in 1987, by method of transportation

Method of transportation	Quantity (thousand short tons)	Percent
Truck	613,760	51
Rail	50,435	4
Water	29,271	3
Other	26,968	2
Not transported	479,696	40
Total	[1]1,200,100	100

[1]Data do not add to total shown because of independent rounding.

FOREIGN TRADE

Exports.—Compared with those of 1986, exports of crushed stone increased 10.3% to 3.2 million tons, while the value decreased 29.5%. About 97% of the exported crushed stone was limestone, of which more than 99% was exported to Canada.

Imports.—Imports of crushed stone increased 25.5% to 3.6 million tons, and 14.7% in value to $12.5 million. About 37% of this tonnage was limestone, 84% of which came from Canada, 8% from the Bahamas, and 5% from Mexico.

Imports of calcium carbonate fines decreased 25% to 265,000 tons, and 2% in value to $1.5 million. Eighty-six percent of the natural chalk came from the Bahamas, while most of the processed calcium carbonate was imported from France, 84%; the United Kingdom, 7%; and Japan, 5%.

Shipments of crushed stone from Scotland, the United Kingdom, and Nova Scotia, Canada, into the United States continued in 1987 and were mostly responsible for the increase in total imports. The imported crushed stone, used mostly as construction aggregates, was distributed in North Carolina, South Carolina, Florida, Louisiana, and Texas. This trend was expected to increase significantly as a result of recent developments in Canada and Mexico. The Newfoundland Resources & Mining Co. Ltd. of Mississauga, Ontario, Canada, a subsidiary of Explaura Holdings PLC of London, United Kingdom, is developing a crushed stone quarry in Lower Cove, Newfoundland, Canada. The company plans to market its high-quality crushed limestone to end users in the construction, chemical, metallurgical, and mining industries on the east coast of Canada and the United States. The quarry is expected to become operational in 1989. Vulcan of Birmingham, AL, formed a joint venture with Mexico's Calizas Industries del Carmen S.A. to develop a limestone quarry on the Yucatan Peninsula that will produce construction aggregates to be marketed in Florida, Louisiana, and Texas. The shipments of crushed stone are expected to begin in late 1988 or early 1989.

Table 20.—U.S. exports of crushed stone in 1987, by destination

(Thousand short tons unless otherwise specified)

Destination	Quartzite	Limestone[1]	Other	Total
North America:				
Bahamas			182	182
Bermuda		893		893
Canada	815	3,105,138	67,772	3,173,725
Dominican Republic			413	413
Leeward and Windward Islands			1,719	1,719
Mexico	908	321	4,578	5,807
Other	148	55	24	227
Total	1,871	3,106,407	74,698	3,182,966
South America:				
Chile		751	21	772
Ecuador			113	113
Venezuela	59	63	1,164	1,286

See footnote at end of table.

Table 20.—U.S. exports of crushed stone in 1987, by destination —Continued

(Thousand short tons unless otherwise specified)

Destination	Quartzite	Limestone[1]	Other	Total
South America —Continued				
Other	—	13	85	98
Total	59	827	1,383	2,269
Europe:				
France	366	—	18,253	18,619
Germany, Federal Republic of	1,171	—	253	1,424
Netherlands	591	—	1	592
United Kingdom	469	55	1,514	2,038
Other	392	15	425	832
Total	2,989	70	20,446	23,505
Asia:				
Japan	3,064	64	2,223	5,351
Korea, Republic of	1,499	—	54	1,553
Taiwan	54	38	298	390
Other	84	—	273	357
Total	4,701	102	2,848	7,651
Oceania	231	1,434	2,655	4,320
Middle East and Africa	20	—	121	141
Grand total	9,871	3,108,840	102,141	3,220,852
Total value thousands	$6,337	$15,412	$4,313	$26,063

[1]Includes ground limestone.

Source: Bureau of the Census.

Table 21.—U.S. imports for consumption of crushed stone and calcium carbonate fines, by type

(Thousand short tons and thousand dollars)

Type	1986		1987	
	Quantity	Customs value	Quantity	Customs value
Crushed stone and chips:				
Limestone	1,454	6,466	1,330	4,775
Marble, breccia	3	190	3	333
Quartzite	6	335	67	1,234
Slate	5	76	1	66
Other	1,396	3,836	2,193	6,092
Total[1]	2,864	10,902	3,595	12,500
Calcium carbonate fines:[2]				
Natural aragonite[3]	345	948	257	856
Chalk, whiting	5	600	5	668
Total[1]	351	1,548	263	1,524
Grand total[1]	3,215	12,451	3,858	14,024

[1]Data may not add to totals shown because of independent rounding.
[2]Excludes precipitated calcium carbonate.
[3]Includes some chalk and other calcareous materials.

Source: Bureau of the Census.

WORLD REVIEW

Canada.—The 1986 production of stone in Canada was 107.6 million tons valued at $489 million; about 95% of this output was crushed stone. The Province of Ontario continued to be the largest producer of stone with 45 million tons valued at $226 million, followed by Quebec with 36 million tons valued at $172 million. Preliminary estimates for 1987 stone production indicate an increase of about 11% to 117 million tons valued at $547 million, with the Province of Ontario accounting for about 48% of the total output.

United Kingdom.—The 1986 production of crushed stone for construction purposes was 137 million tons, as reported by the British Aggregate Construction Materials Industries Association. About 79% of this output was limestone and dolomite. The Southwest was the largest producing region with 40.0 million tons, followed by East Midlands with 38.3 million tons, and Wales with 26.2 million tons. About 64% of the total crushed stone production was limestone and 28% was igneous rock. Preliminary production figures for 1987 indicated an increase of about 16% compared with those of 1986.

TECHNOLOGY

The introduction of sophisticated electronic equipment and computer systems used to improve the efficiency of mining and processing operations continued in the crushed stone industry. On the increase was the use of computer programs that formulate plant design, including selection of types and sizes of crushers and screens, complete with blueprints and flow diagrams. The use of computerized systems that provide a high degree of automation in the day-to-day operation of the plant, quality control, and computerized truck dispatch systems was also on the upswing in crushed stone quarries. Operations such as blasting, excavation, crushing and screening, and loading and hauling, have advanced into highly technical disciplines that use a wide range of automated equipment. In addition to investing in larger equipment, most producers can significantly improve the efficiency of their operations through automation.

In August, Genstar Stone Products Co. of Hunt Valley, MD, a subsidiary of Redland PLC of Groby, United Kingdom, dedicated a $10 million crushed stone plant at its Texas, MD, quarry. The plant is controlled by a sophisticated central computer system that allows the simultaneous production of as many as eight different products, ranging from riprap to manufactured sand. The entire plant is run by three operators, one in the central computer control room, one in the primary crusher control room, and one on the ground. Twelve closed-circuit TV monitors and two computer screens in the central control room provide a continuous visual display of the operating status of each of the main plant sections. They also provide the operator with information about production rate, cumulative production figures, plant running times and down times, as well as a daily log of events. Genstar's Texas quarry is considered to be one of the most technologically advanced automated quarries in the world.[9]

Construction of a pilot plant that will convert phosphogypsum, a waste product of the phosphate industry, into aggregates for road and building construction was started in August 1987. The pilot plant is being built in Convent, LA, by Freeport-McMoRan Inc. to test a new proprietary technology developed by Davy McKee Corp. and the Florida Institute of Phosphate Research. In the process, a mixture of phosphogypsum, petroleum coke, waste phosphoric clays, and pyrites is fed onto a circular grate and is processed in a series of sealed zones on the grate. The raw gas, high in SO_2, is collected and fed to a metallurgical-type sulfuric acid plant, and the sintered, clinker-like byproduct is discharged from the grate in dry form. The pilot plant is designed to convert 35 tons per day of phosphogypsum into 29 tons per day of sulfuric acid and 25 tons per day of aggregates. The pilot plant will cost $2 million to construct and another $1 million to operate for 6 months. The breakthrough in developing an economical process to convert phosphogypsum into useful products comes at a time when disposal of the byproduct waste had become an environmental issue in Louisiana.[9]

Hillhead '87 Review, the fourth biennial quarry exhibition featuring actual equipment working at the show site, was held at Tarmac's Hillhead Quarry, near Buxton,

Derbyshire, United Kingdom. A wide range of loaders, crawlers, trucks, specialized railroad cars, mobile and stationary crushers, rock breakers, screening plants, and heavy construction equipment were put to work in the quarry during the show. In addition, more than 100 exhibitors displayed static equipment and accessories in a large pavilion at the center of the quarry. This international exhibition is becoming one of the most important quarrying and heavy construction equipment shows in the world.[4]

Results of various techniques that were tested over the years indicate that high calcium carbonate limestone is the product of choice for reducing the acidity of contaminated lakes and streams in Canada, Finland, Norway, Sweden, and the United States. Limestone is relatively inexpensive, noncaustic, dissolves easily, and is easy to handle. The limestone used for liming surface waters comes in three forms: dry powder that is used in lakes, preslurried material used in streams, and granular limestone used in rivers. Sweden was the first country to use limestone for treatment of acidic surface waters. Between 1977 and 1982, 1,500 lakes and streams were treated in Sweden as part of an experimental program. Later the program was extended to one-half of the country's surface waters. In the United States, 81 projects were initiated to assess the adverse effects of acid deposition on lakes and streams, while experimental liming projects were conducted in Maryland, Massachusetts, Minnesota, Tennessee, and West Virginia.[5]

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[1]Physical scientist, Branch of Industrial Minerals.

[2]Hill, B. Automation Repays Investment at U.S. Quarry. Quarry Mgmt. (Nottingham), May 1988, pp. 9-22.

[3]Rukavina, M. Phosphate Industry Hopes To Turn Phosphogypsum Waste Into Aggregates. Rock Prod., v. 90, No. 9, Sept. 1987, pp. 17, 78.

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